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# ABSTRACTS

**GR-11. Mössbauer studies of multiferroic spinel $CoCr_{1.98}{}^{57}Fe_{0.02}O_4$**

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In order to elucidate the role of Cr ions in $CoCr_2O_4$ exhibiting multiferroic property [1, 2], we have substituted a small amount of Fe ions for Cr sites and investigated the magnetic behavior of Fe ions, on atomic scale, using Mössbauer measurement. Polycrystalline $CoCr_{1.98}{}^{57}Fe_{0.02}O_4$ compound was prepared by wet-chemical process. The crystal structure was found to be single-phase cubic spinel with space group of Fd3(-)m. The lattice constant $a_0$ and the internal structural parameter ($x$) of the oxygen were determined to be 8.340 Å and 0.264, respectively. Mössbauer spectra of $CoCr_{1.98}{}^{57}Fe_{0.02}O_4$ were taken from 4.2 to 295 K using a $^{57}Co$ source in a rhodium matrix. The absorption spectra at 4.2 K show that the well developed two sextets are superposed with small difference of hyperfine field ($H_{hf}1$ = 488 and $H_{hf}2$ = 478 kOe). Isomer shift values ($\delta$) of the two sextets are found to be 0.34 and 0.35 mm/s relative to the Fe metal, respectively, which are consistent with the high spin $Fe^{3+}$ charge state. With increasing temperature of the sample, the sextets gradually come to split into two sub-spectra, and then around 27 K absorption line-broadening of outer sextet appears rapidly. Above Néel temperature ($T_N$ = 97 K) two paramagnetic doublets are observed. We note that the sudden change of outer sextet is observed at about 27 K, which is corresponding to the spin transition temperature reported by Yamasaki et al. [2]. From the results of Mössbauer measurement, it is suggested that $Cr^{3+}$ ions have two different magnetic sites, and the magnetic complexity dependent on temperature is attributable to the different behaviors of magnetic ions in the two sites.

1]. G. Lawes, et al., Phys. Rev. B 74, 024413 (2006). 2]. Y. Yamasaki, et al., Phys. Rev. Lett. 96, 207204 (2006).